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can be brought to each side in succession. The depth of the cavern seems to have little effect. I have called up the occupant from a burrow which subsequent examination has proved to be eighteen inches deep. Unless she has been deceived several times, she usually runs up rapidly, and will occasionally snap at the end of the straw. While experimenting, it is hardly possible to avoid introducing fragments of the tower, or adherent particles of earth, and it occurred to me that these might be the call to which the spider responded; but sand from an ant-hill, sprinkled in freely, had no effect.

Mrs. Mary Treat, writing of another species of *Tarantula*, says that all food-remains were ejected in the same way as the earth pellets. *Tarantula arenicola* is not so neat. The earth beneath old burrows is often darker than the walls, and densely filled with fine rootlets. It is probably darkened and enriched by the spider's excrement and food-remains. From burrows in the field it is the rule to take masses of *débris*, which consist of the spider's exuviae, the heads and legs of ants, the elytra and other chitinous parts of beetles, with fragments of insect-wings. It seems that the dead and empty bodies are torn to pieces, and scattered at the bottom. This was done by a captive which would not dig, but which accepted maimed flies. After extracting the juices, the spider tore the body into fragments so small that only careful search could find them. In but two instances have I observed an ejection of food-remains. A mutilated fly was seized from a tower, and twenty-four hours later I did find what appeared to be the desiccated remains. In the second case, two spiders were fighting fiercely when set free at evening, near the burrow of a small specimen in the garden. During the night the occupant of the burrow was dislodged, and the vanquished spider had been dragged into the pit which the conqueror had enlarged, and whence, in the course of the morning, fragments of the dead body were thrown out, among them the abdomen severed from the thorax, but not otherwise mutilated. Occasionally, also, an elytron can be found near a tower in the field.

This disposition of remnants is somewhat remarkable; since spiders in general are cleanly, and since this one is particularly intolerant of intrusive objects. A straw or stem dropped into the burrow is immediately carried up, and tossed away. The only instance observed, where a young spider ascended backward, was when trying to get a heavy stick out of

the pit: having lifted in vain, she attempted to pull.

Noticing the fondness for ants, a number of bran-cracker crumbs were sprinkled at a distance of six inches from the tower, and an ant was soon struggling under a load larger than itself. Suddenly the spider on the tower started, erect and rigid: she leaped to the ground, she ran six inches, she seized that bit of cracker, and retreated with it to her burrow, leaving the emmet on its back in the dust. For two hours she remained below. The following day I twice witnessed the same performance. The spider once overran the crumb, and so lost it. At the third time, the piece of biscuit became wedged in the tower as the spider was running in backward, and I plainly saw her nibbling at it. During a momentary absence for forceps to remove it, to examine for marks of mandibles, the spider carried it down and out of sight. The fragments were not touched, except as they were being borne about by the ants. Is it usual for spiders to take any but animal food?

DR. ALFRED C. STOKES.

THE EXPLORING VOYAGE OF THE CHALLENGER.

(Second Notice.)¹

PROFESSOR HERDMAN has published the first part of his memoir upon the Tunicata (vol. vi., 296 p., 37 pl.), which treats solely of the 'Ascidiae simplices,' the composite and pelagic forms being reserved for future consideration. From the historical preface to the index, this report is a model of systematic arrangement; the bibliography, and the chapter on anatomy and classification, being worked out with especially elaborate care. The most important generalizations reached are: 1. These simple ascidians are not numerous in the northern hemispheres, are comparatively scarce in tropical latitudes, and attain the greatest abundance in southern temperate regions; 2. Although simple ascidians occur in very deep water, and are fairly represented in the abyssal zone, they are chiefly a shallow-water group, and are most numerous around coasts in a few fathoms of water; 3. The occurrence of simple ascidians does not depend upon temperature or character of bottom. The discussion of questions affecting the Tunicata as a class is reserved for the second part of the report. The phylogenetic table on p. 286 is of great interest.

¹ See No. 66.

There still remain to be published a number of reports upon Mollusca, — Huxley on the cephalopods, Boog Watson on the gasteropods, E. A. Craven on the pteropods and heteropods, Rudolph Bergh on the nudibranchiates, E. A. Smith on the lamellibranchiates, and Busk on the Polyzoa; the first instalment of the latter paper being announced for the next volume.

In his report upon the Brachiopoda (vol. i., 67 p., 4 pl.; also *Proc. royal soc.*, xxvii. p. 428), Professor Thomas Davidson of Brighton discusses the 31 species and varieties obtained, and presents a catalogue of the recent species at present known. Although the dredge was put down at 361 stations, brachiopods were found only thirty-nine times. The greater bulk of known species live at comparatively moderate depths, few as deep as 500 fathoms, and are specifically rare from 500 to 2,900 fathoms. It is also shown that the same species is capable of existing at different depths, without any observable modification in shape and character. Frequent allusions are made to the American authorities Dall and Morse, the opinions of the former being referred to on almost every page.

Dr. F. Buchanan White, in his Report on the pelagic Hemiptera (vol. vii., 82 p., 3 pl.), discusses the interesting oceanic insects belonging to the genera *Halobates* and *Halobates*. He concludes that the region between the eastern part of the Indian Ocean and the West Pacific is the birthplace of the genus *Halobates*, whence it has spread to other parts

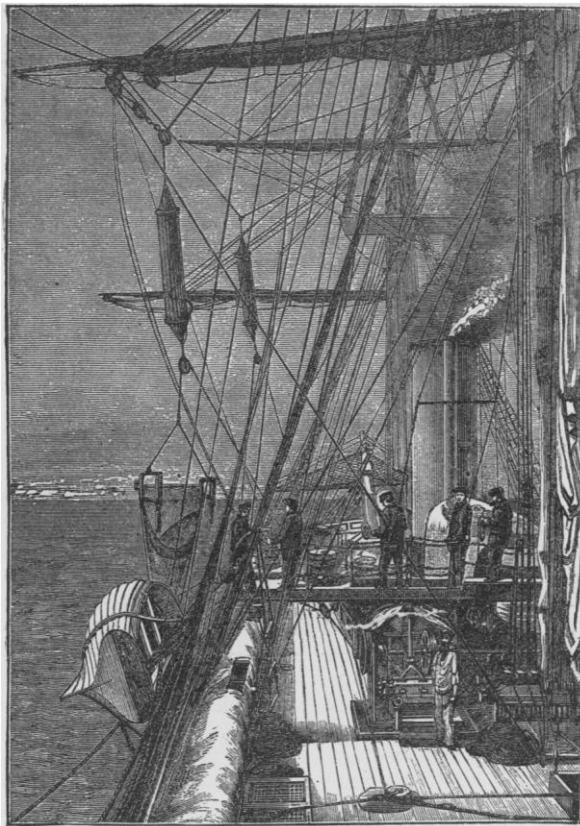
of the world, *Halobates* being one of its derivatives.

The monograph of the anatomy of *Peripatus*, begun by the late Professor Balfour, has already been published under the editorship of Moseley and Sedgwick, the latter of whom is now continuing the subject by the use of material collected by himself at the Cape of Good Hope last summer. It is questionable, therefore, whether this will form part of the Challenger series.

Dr. P. P. C. Hoek of Leyden has printed his report upon the Pycnogonida (vol. iii., 167 p., 21 pl.), which, in addition to discussing the 41 species dredged by the Challenger and the Knight Errant, 33 of which were new, contains a critical review of the genera and species, 129 in number already known to science, in which frequent complimentary references are made to the work of our countryman, E. B. Wilson, upon the same group. The most important generalizations obtained are: 1. That those genera which range most widely geographically are also those which range most widely in depth;

2. That, though there are deep-sea species, deep-sea genera do not appear to exist. The author admits his inability to show any definite influence of deep-water habitat upon the form and structure of the animals under consideration.

Dr. Hoek's report on the Cirripedia (vol. viii., 189 p., 13 pl.) appears to be a very carefully executed and scholarly essay. Its usefulness is greatly enhanced by a well-made index, and an introduction in which the history of the group, and its literature since the



THE DREDGING AND SOUNDING APPARATUS ON BOARD THE CHALLENGER. (Copied from *The Atlantic*.)

publication of Darwin's monographs, are carefully and critically summarized. Darwin knew 147 species of cirripeds; 18 were added by his successors; while, in the present report, 59 are described, together with 1 new generic type; 78 species, in all, having been collected. The percentage of new material in this group was therefore unusually great.

Out of 34 genera known, 28 have never been observed at a depth greater than 150 fathoms. It is shown that there are no deep-sea genera; for, even of the two genera ranging lowest in depth, species are known from shallow water. Dr. Hoek's discussion of these two genera, in which he shows that their occurrence in great depths coincides in a striking manner with their paleontological history, is very suggestive; as is also his statement, that, in the case of *Scalpellum*, the deep-sea rather than the shallow-water forms have preserved the character of the oldest fossil species of the genus, while, in the case of *Pollicipes*, the more archaic types are found in shallow water. The author also points out the fact, that, while the deep-sea genera have a world-wide range, the deep-sea species ordinarily have only a very limited distribution.

A most laborious paper is that upon the Ostracoda (vol. i., 184 p., 43 pl.), by Prof. G. Stewardson Brady of Sunderland, with its almost endless array of figures, at least 2,000 in number. The paper is almost entirely descriptive; families, genera, and species, old as well as new, being fully characterized. Out of the 220 species obtained, 143 were new; and only 15 of the entire number catalogued owe their names to other authority than the author. The deductions concerning geographical distribution are, of course, very interesting. It is shown that Ostracoda occur very sparingly in the oceanic abysses: only 19 species were found at depths below 1,500 fathoms, and only 52 below 500. The materials for a study of the horizontal distribution of the group were not very extensive; and it is evident that there is still an immense amount to be done in the study of Ostracoda in all parts of the world, particularly in the shallow waters, which the Challenger rarely touched.

The report upon the Copepoda, by the same author (vol. viii., 142 p., 55 pl.), is also purely descriptive: 106 species are enumerated, of which 47 are described as new, 10 new generic types being defined. It is an interesting evidence of the exhaustive character of Dana's work while connected with the Wilkes exploring expedition, to note, that, out of the 90 species of free-swimming Copepoda collected,

30 were described by him, and that sixty per cent of the previously described forms in the list bear his name. Professor Brady's drawings and descriptions are admirably executed. The lack of an index to text and plates is, however, much to be regretted. The Challenger Copepoda were almost without exception obtained by surface towing. The only undoubted deep-sea species was *Pontostratotes abyssicola*, of which a single specimen was obtained at 2,200 fathoms.

Many of the reports on crustaceans are yet to appear, — discussions of the brachyurans, by E. J. Miers; the anomurans, by Professor Jules Barrois, director of the zoölogical laboratory at Villefranche; the macrurans, by C. Spence Bate; the Amphipoda, by the Rev. T. R. R. Stebbing; and the Cumacea, Schizopoda, Stomatopoda, and Isopoda, by authorities not yet named.

Nothing whatever has been printed upon the Vermes as yet. The annelids are in the hands of Dr. W. C. McIntosh. Professor Ray Lankester has the gephyreans; and Dr. Ludwig Graff, the Myzostomidae. The assignment of the Chaetognatha to Dr. Oscar Hertwig was announced in 1880; but this group has been omitted in later lists — without explanation, however, and it is to be hoped unintentionally.

The report upon the Holothurioidea, by Dr. Hjalmar Théel of Upsala (vol. iv., 176 p., 46 pl.), is one of the most interesting of the special descriptive papers; since the deep-sea holothurians are shown to constitute a group by themselves, specially characteristic of the abyssal fauna, and very different from the littoral forms hitherto known. This group, which is placed by the author in a new order, *Elasipoda*, is believed by him to have in certain respects attained a higher development than all the other echinoderms, — "a development which is gradually approaching the higher classes of animals." Previous to the publication of this report, only three animals of this group were known; these having been brought in by the Swedish and Norwegian dredging expeditions of 1875, 1876, and 1878. There are here described 52 species and 3 varieties, distributed into 19 genera. Of this entire number, only 4 are found at depths less than 500 fathoms, as many more from 500 to 1,000, the remainder from 1,000 to 2,900 fathoms. "Thus we learn that the *Elasipoda* abound over the floor of the ocean at great depths, and that the number of species and of individuals is greatly reduced shorewards."

G. BROWN GOODE.